COMPACT SOLAR SYSTEM
UPPER TANK THERMOSIPHON MODELS:

Ultraselective Family			
TA150UFM	TA200 UFM	TA250 UFM	TA300 UFM
TA150UF	TA200UF	TA250UF	TA300UF
	TA200 UFX		TA300 UFX
Selective Family			
TA150PFM	TA200 PFM	TA250 PFM	TA300 PFM
TA150PF	TA200PF	TA250PF	TA300PF
	TA200 PFX		TA300 PFX

Installation and User Manual

1. PHYSICAL CHARACTERISTICS AND COMPONENTS

1.1. CONTENTS

Each system model comes with the following elements:

	Collector Model	Number of colletors	Tank Model	Empty weight
T150UF/T150PSF	T20US/T20PS	1	ATF150I	142
T150UFM/T150PFM	T25US/T25PS			144
T200UFX/T200PFX	T20US/T20PS	1	ATF200I	161
T200UF/T200PF	T25US/T25PS			163
T200UFM/T200PFM	T20US/T20PS	2		201
T250UF/T250PF	T25US/T25PS	1	ATF250I	183
T250UFM/T250PFM	T20US/T20PS	2		221
T300UFX/T300PFX	T25PS/T25PS	1	ATF300I	198
T300UF/T300PF	T20US/T20PS	2		236
T300UFM/T300PFM	T25US/T25PS			240

And the following accessories are standard in all systems depending on the model:

CAPACITY	150 L	200 L	250 L	300 L
Kit	1	1	1	1
Short connection	1	1	1	1
Long connection	1	1	1	1
Thermal Relief Valve 90ºC 6 bar	Optional	Optional	Optional	Optional
Thermostatic Mixing Valve	Optional*	Optional*	Optional*	Optional*
Heating Element 1500 W + Thermostat	Optional	Optional	Optional	Optional

* The thermostatic mixing valve is required on computers without prior checking of temperature according to current laws

1.2. SOLAR COLLECTOR

Developed to use at low temperature applications (below 100º C), its design is based on the "greenhouse" effect and absorbent surfaces. The most advanced materials are used to make them so that they are long lasting and provide maximum energy return.
The main features of the Termicol T20PS, T25PS, T20US and T25US solar collectors are shown below:

	T20PS	T25PS	T20US	T25US
Length (mm)	2.130			
Width (mm)	970	1200	970	1200
Thickness (mm)	85			
Gross Surface Area (m^2)	2,07	2,56	2,07	2,56
Surface Area Used (m^2)	1,92	2,39	1,92	2,39
Surface Area of the Absorber (m^2)	1,88	2,36	1,88	2,36
Optical Performance	0,76	0,75	0,80	0,79
K_1 Loss Factors (W/ K*m^2)	6,66	5,48	3,93	3,49
K_2 Loss Factors (W/ K*m^2)	0,007	0,022	0,028	0,018
Empty weigth	37	39	37	39
Fluid Capacity (lit.)	1,02	1,27	1,02	1,27
Recommended Flow (lit./h*m^2)	40			
Absorber Material	Aluminum / Copper			
Absorber Coating	Selective Coat		Ultraselective Coat	
Copper Fin Thickness (mm)	0,4			
Number of Channels	8	10	8	10
Channel Diameter (mm)	8			
Manifold Pipe Diameter (mm)	18			
Shell	Aluminum			
Cover Material	Tempered Glass 3.2 mm			
Insulation	40 mm, semi-rigid rock wool			

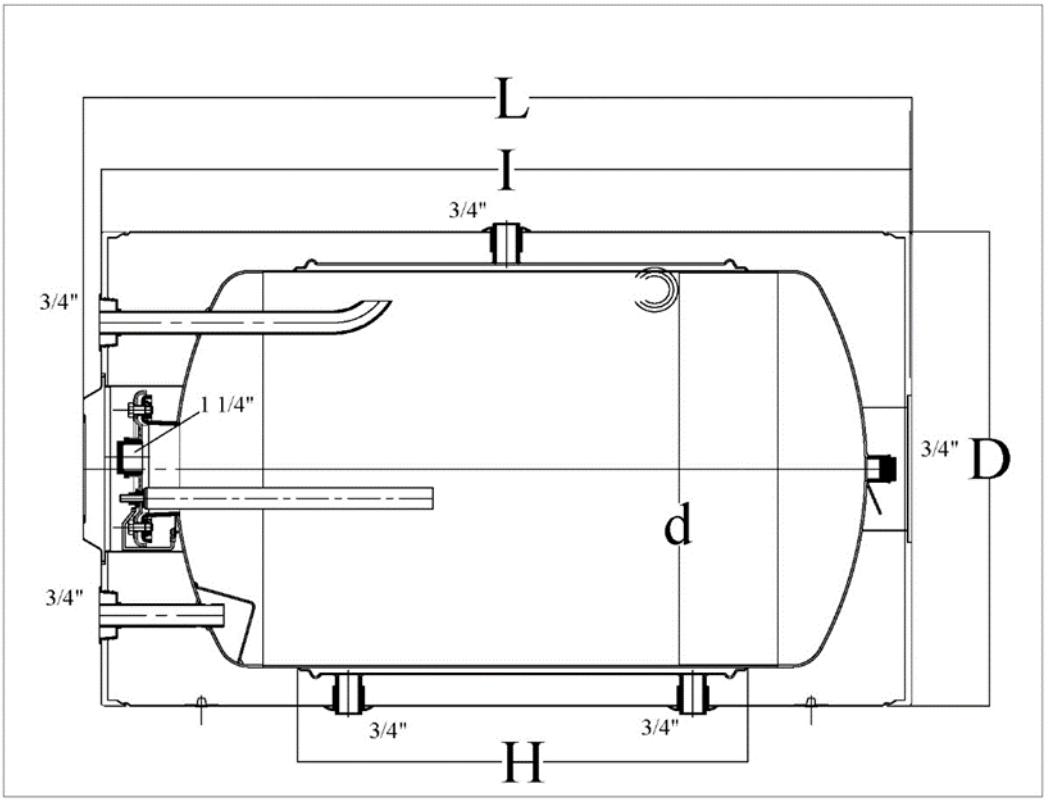
1.3. HEAT STORAGE TANK

The tanks are made of **enameled steel** sheets to prevent problems with rusting and corrosion and to guarantee that the tank lasts for a long time.

They are given a **magnesium anode** for cathodic protection, which should be checked once a year.

The main feature of the new storage tanks for Termicol thermosiphon system is that **they do not need an expansion tank** for normal operation. A gas chamber in the membrane of the tank provides for the expansion of the primary circuit fluid.

In addition, the new Termicol tanks have lateral handles that facilitate their handling and installation.



	ATF 150l	ATF 200l	ATF 250l	ATF 300l
Volume	150 litres	200 litres	250 litres	300 litres
Max. Temp 1º circuit	110 ºC	110 ºC	110 ºC	110 ºC
Max. Press. 1º circuit	250 kPa (2,5 bar)	251 kPa (2,5 bar)	251 kPa (2,5 bar)	252 kPa (2,5 bar)
Exchanger surface area	0,81 m^2	0,97 m^2	1,38m^2	1,78 m^2
Volume 1º circuit	6,7 litres	10 litres	11,2 litres	16,6 litres
Max Tª 2º circuit	90 ºC	90 ºC	90 ºC	90 ºC
Max .Press. 2º circuit	800 kPa (8 bar)	801 kPa (8 bar)	801 kPa (8 bar)	802 kPa (8 bar)
Length (L)	1.006 mm	1.230 mm	1.581 mm	1.768 mm
Inside Length (L)	984 mm	1209 mm	1559 mm	1745mm
Outside Diameter (D)	575 mm			
Inside Diameter (d)	476 mm			
Length Exchanger (H)	545 mm	745 mm	1095 mm	1245 mm
Empty weight (kg)	76	95	115	130
Inside Protection	Enamelling DIN 4753			
Insulation	38 mm. Super insulation injected polyurethane (CFC and HCFC free)			
Inside Protection	Galvanized Steel with Nanotechnology Lacquered			
Cathodic Protection	Magnesium Anode			

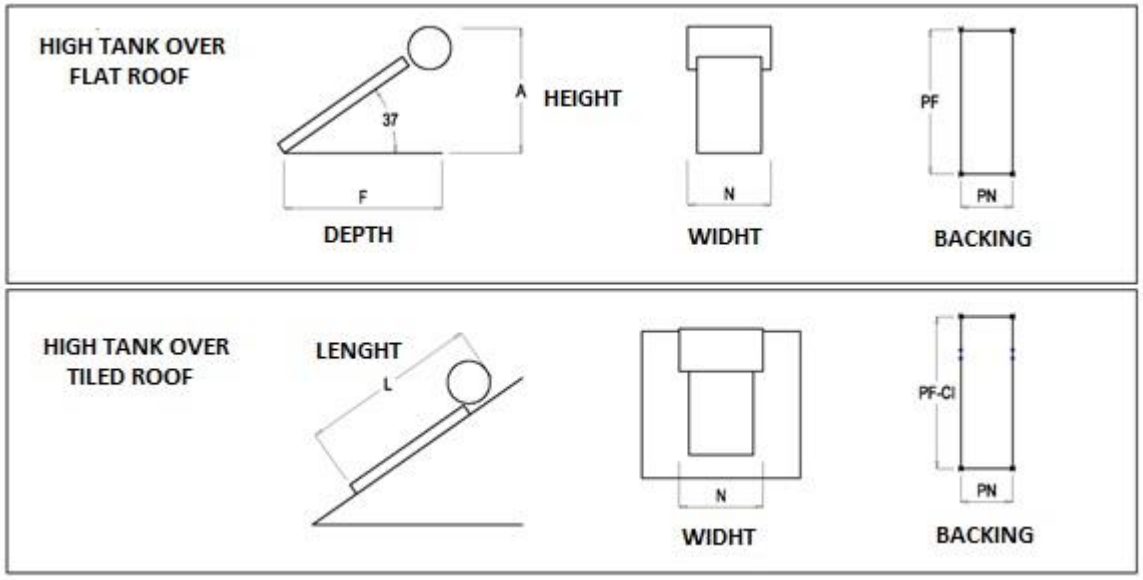
1.4. PROTECTION AND SAFETY SYSTEMS

The thermosyphon units of Termicol are protected with some safety systems that allows a very long life of all its components. There are three elements that protect your system:

- Magnesium anode: Allows to avoid the corrosion. It must be reviewed and replaced, if necessary, depending of the quality of consum water
- Dielectric protectors: Avoid the galvanic corrosion in the cold water intel and hot water outlet.
- Safety valves: these elements allow to limit the work pressure in both circuits of the systems: (bellow you can see the technical features)
    - Secondary cirtuit: valve of 6bar (600 kPa)
    - Primary circuit: valve of 2,5 (250 kPa)

Primary Circuit Valve – COD. 132		**Secondary Circuit Valve– COD. 101-S**	
Component	**Materials**	**Component**	**Materials**
Body:	½''; brass CW617N chrome plated	Body :	½''; brass CW617N
Obturator seal:	Nylon with 30% glass wool	Cover:	Aluminum
Spring:	Steel AISI 302		
		Eje:	Nylon with 30% glass wool
		Junta del obturador	Nylon with 30% glass wool
Medium:	water or glycol solutions	Diaphragm:	Silicone 80 SH
Max. Percentage of glycol	50%	Spring:	Steel AISI 302
		Control knlb:	Nylon con 30% glass wool
Nominal pressure:	PN 2,5	Nominal pressure:	PN 8
Temperature range:	-30÷120ºC	Temperature range:	5÷180ºC
Connections:	½'' F	Connections:	½'' F

1.5. DIMENSIONS



VOLUME	F	A	L	N	PN	PF	PF-CI
TA150UF/PF	2156	2063	2848	1023	740	1899	2280
TA150UFM/PFM	2156	2063	2848	1200	740	1899	2280
TA200UFX/PFX	2156	2063	2848	1268	740	1899	2280
TA200UF/PF	2156	2063	2848	1268	740	1899	2280
TA200UFM/PFM	2156	2063	2848	1990	740	1899	2280
TA250UF/PF	2156	2063	2848	1521	1275	1899	2280
TA300UFX/PFX	2156	2063	2848	1784	1275	1899	2280
TA300UF/PF	2156	2063	2848	1990	1275	1899	2280
TA300UFM/PFM	2156	2063	2848	2450	1275	1899	2280

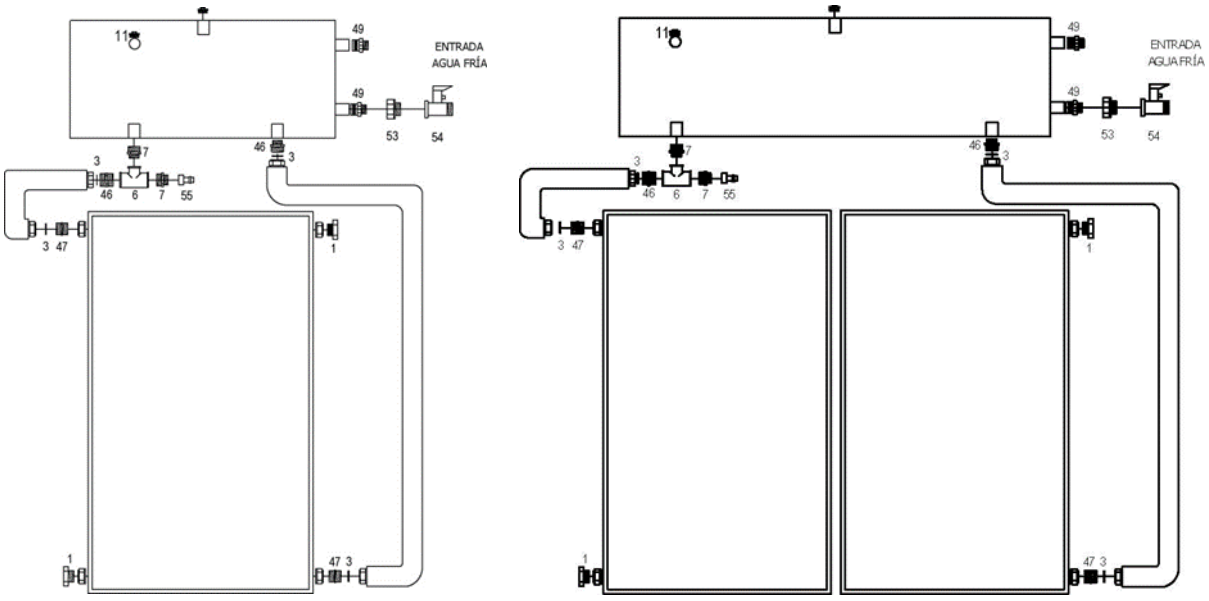
1.6. CONNECTING ELEMENTS

A connection kit is provided containing couplings, valves and specially designed accessories for quick and easy installation. Branch connections between the storage tank and the collectors are also included.

The storage tank has to be installed with the **side intakes on the right side** (as shown in the drawing) since the connections are the exact size for this placement. If you want to set up the system with the intakes on the right side, the installer would have to modify the connections that are provided.

Once the connections are made and tested to see that there are no leaks, all the connections should be insulated.

The thermosiphon system connection elements are shown in the following diagram:



1	RACOM-06	COPPER PIPE COMPRESSION PLUG 18	2
3	CONX-02	JOINT	4
6	TEH-03	BRASS TEE 3/4" -1/2"-3/4" H	2
7	MACHON-02	NIPPLE 3/4" - 1/2"	2
11	TAPONM-04	PLUG ¾ ”	2
46	RACOM-11	NIPPLE 3/4" PLANE – 3/4"	2
47	RACOM-08	NIPPLE 3/4" PLANE – 18	2
49	MANGUIT-03	DIELECTRIC SLEEVE ¾’ M-H	2
53	REDUCM-01	FITTING MARSELLE ¾ " - ½ "	1
54	VALVSEGU-07	SAFETY GROUP 8 bar ½“	1
55	VALVSEGU-08	SAFETY VALVE 2,5 bar ½“	1

1.7. SUPPORT FRAME

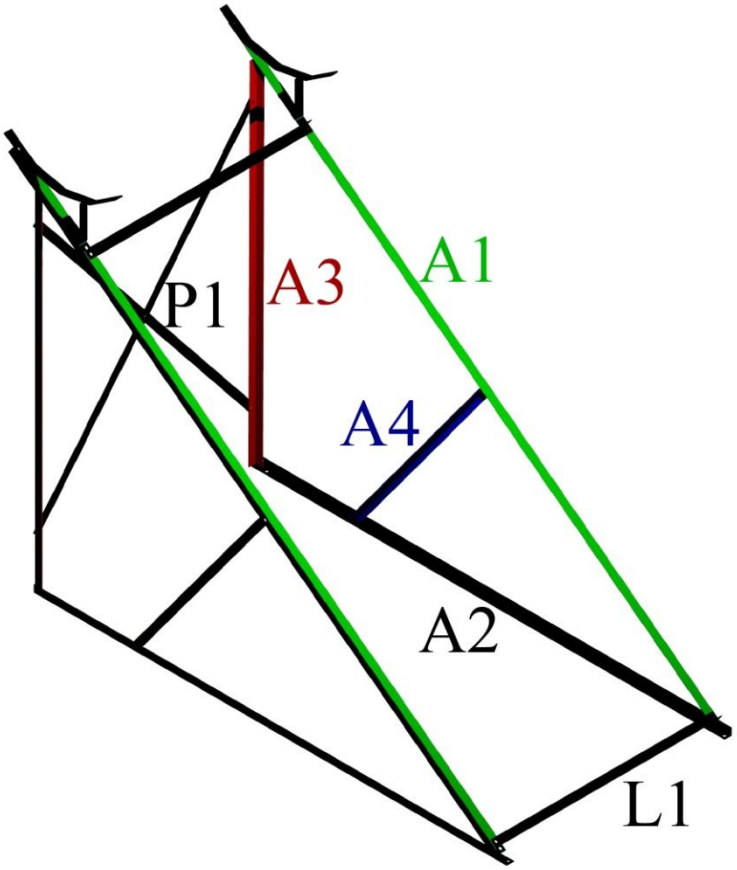
The system support frame is designed with steel forms that are standardized, cut, drilled and afterwards galvanized and lacquered for weatherproofing.

The joint between the different bars that make up the frame are done through stainless steel bolts and screws.

The forms are identified by an alphanumeric code to facilitate the assembly of the frame.

The stand is possible to be mounted in two ways with the same forms if you change the position of them. These configuration allows to instal the system on a flat roof or on a tiled roof.

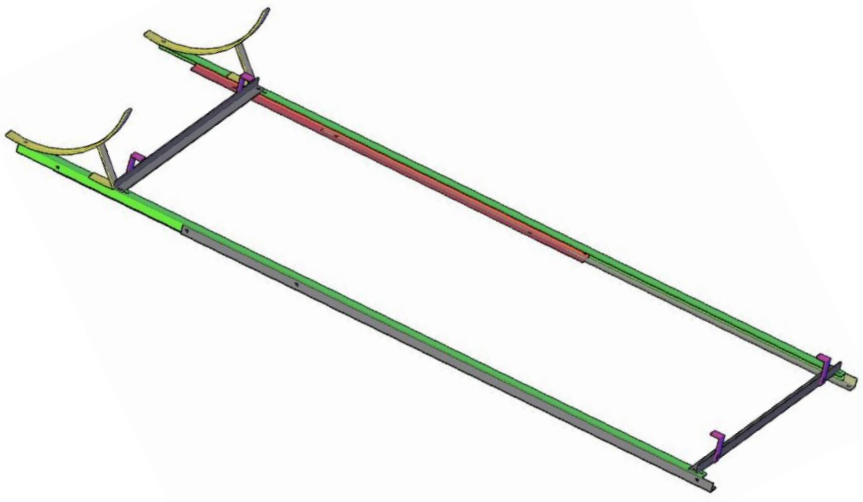
FLAT ROOFS CONFIGURATIONS



Piece	Length (mm)
A1	2531
A2	1962
A3	1455
A4	920
L1 (1 coll.)	920
L1(2 coll.)	1700
P1 (150/200 l)	1350
P1 (300 l)	1700

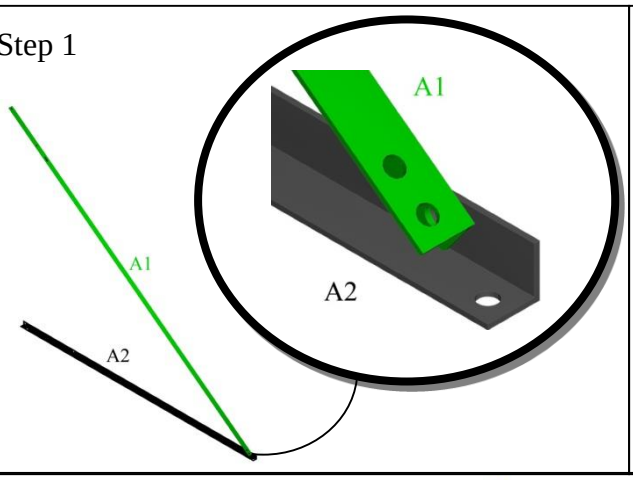
¡Atención! Las estructuras están diseñadas para ser montadas y utilizadas tal y como se establece en este manual de montaje. Cualquier modificación en la configuración establecida supondrá una pérdida de las condiciones de la garantía, quedando eximida Termicol de las responsabilidades derivadas del mal montaje o uso.

TILED ROOFS CONFIGURATIONS

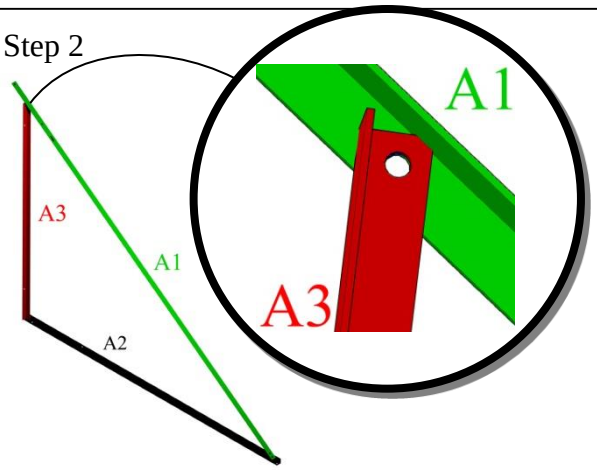


MOUNTING STEPS IN FLAT ROOF FRAME

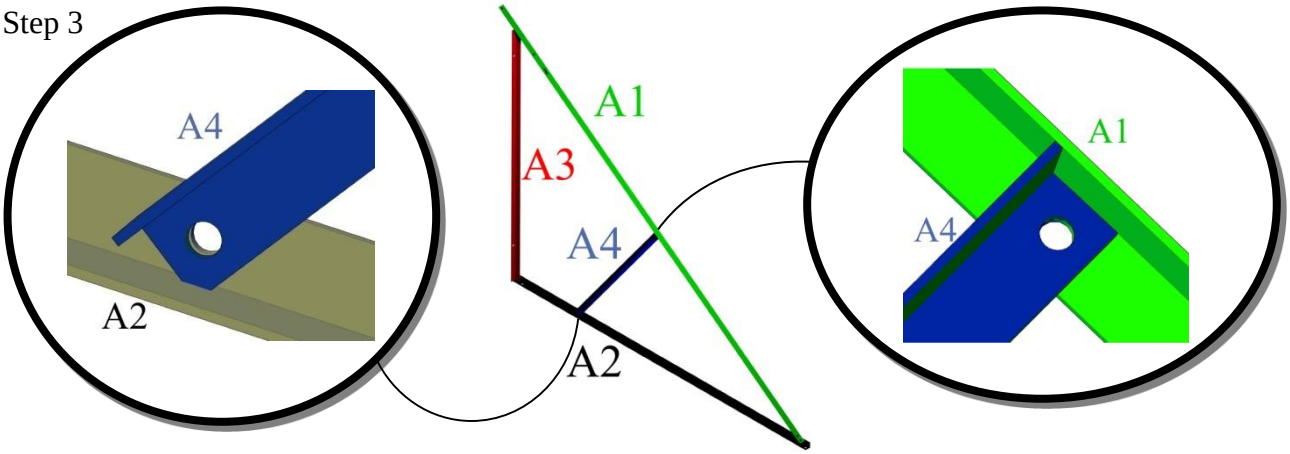
Step 1



Step 2

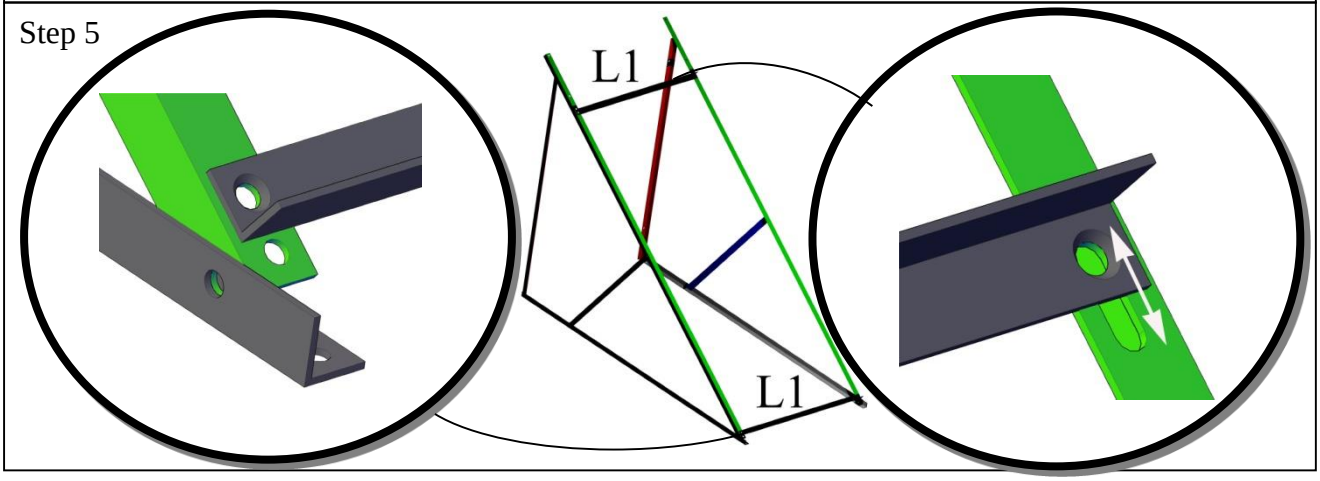


Step 3

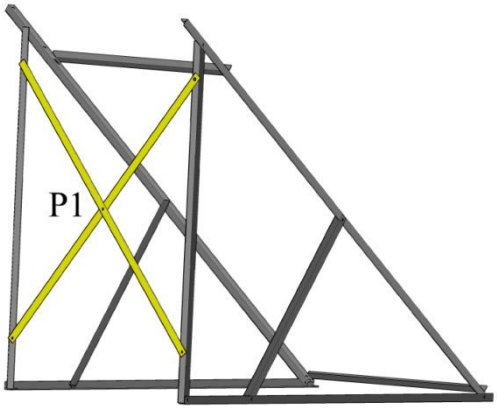


Step 4 Build the oposite side take into account that both sides are as a screen image of the other side.

Step 5

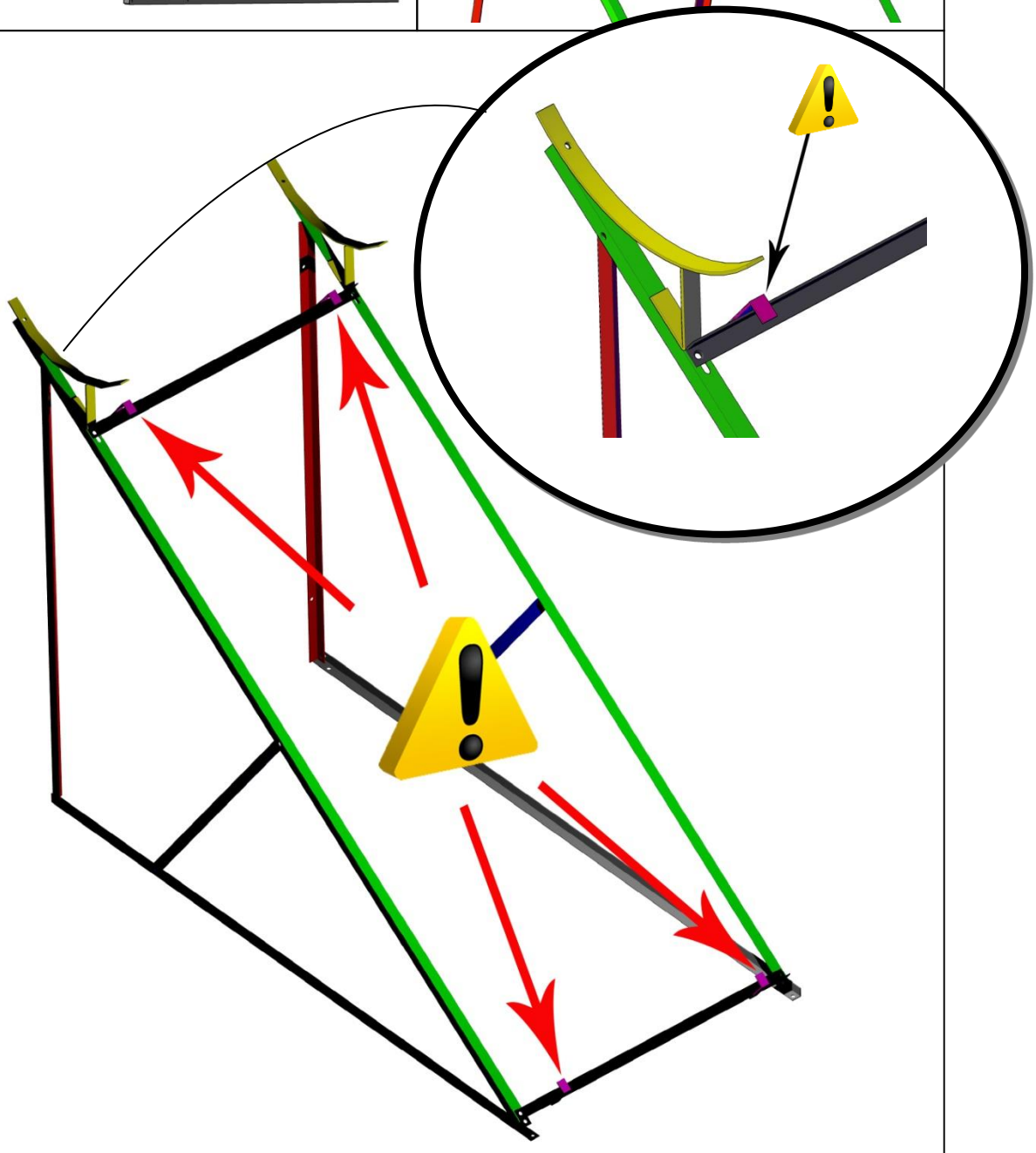


Step 6

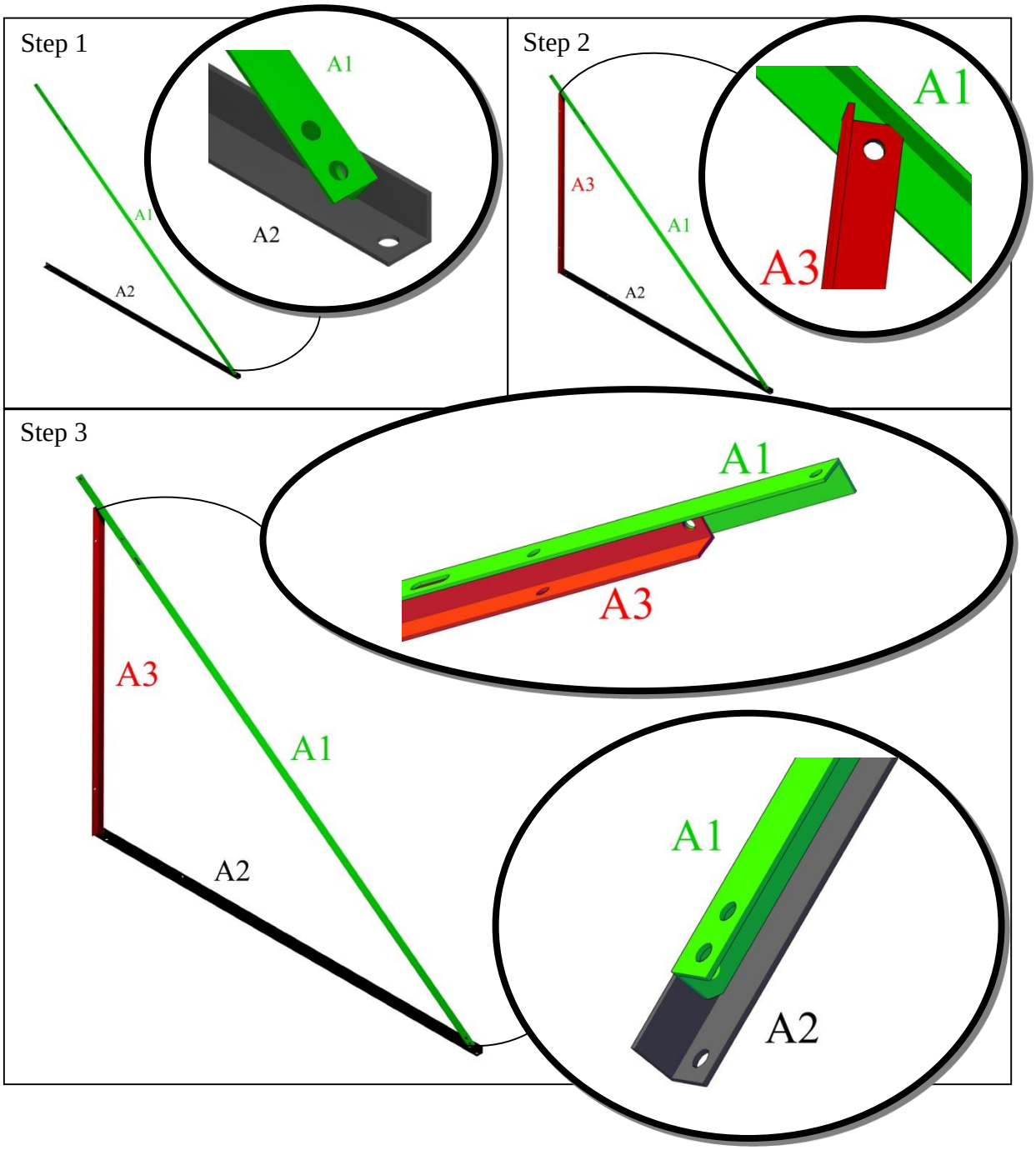


Step 7

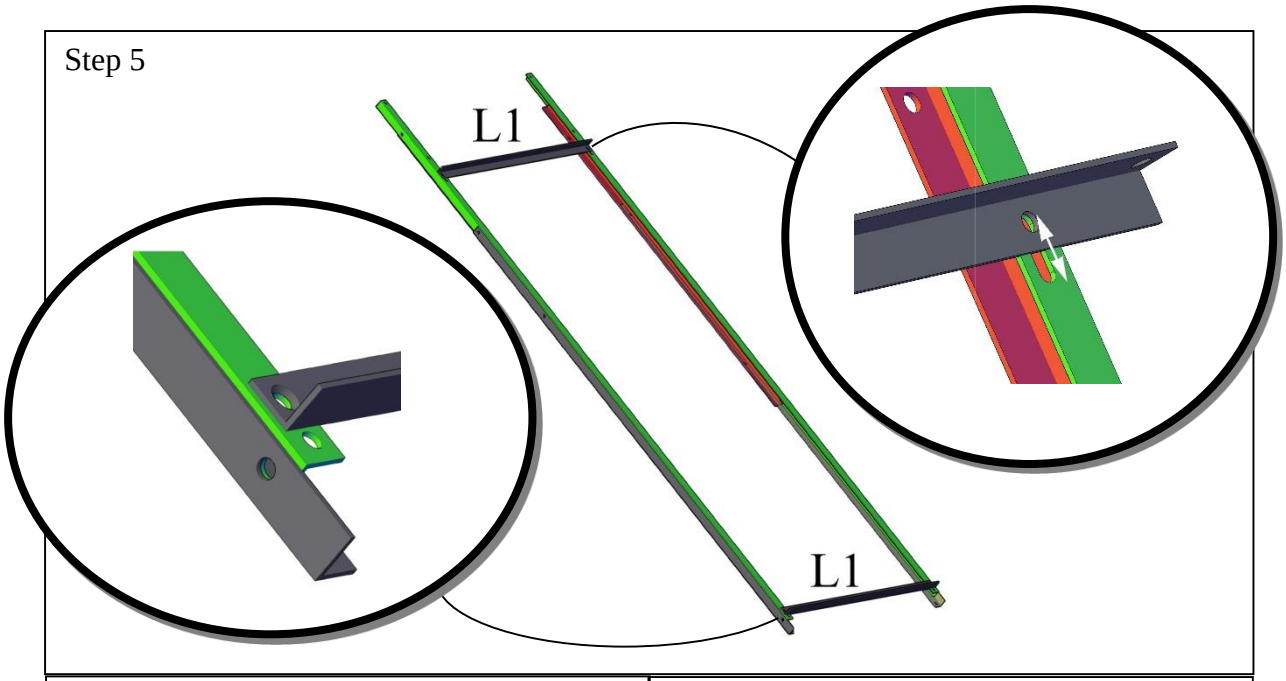
Step 8



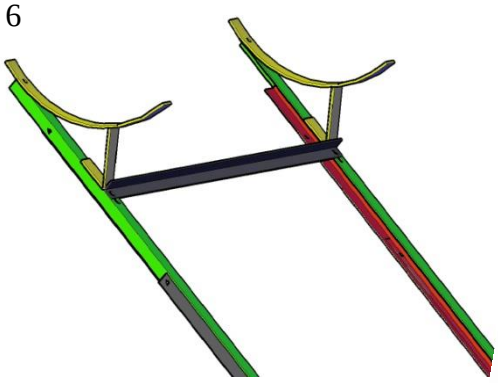
MOUTING STEPS IN SLOPING ROOFS FRAME



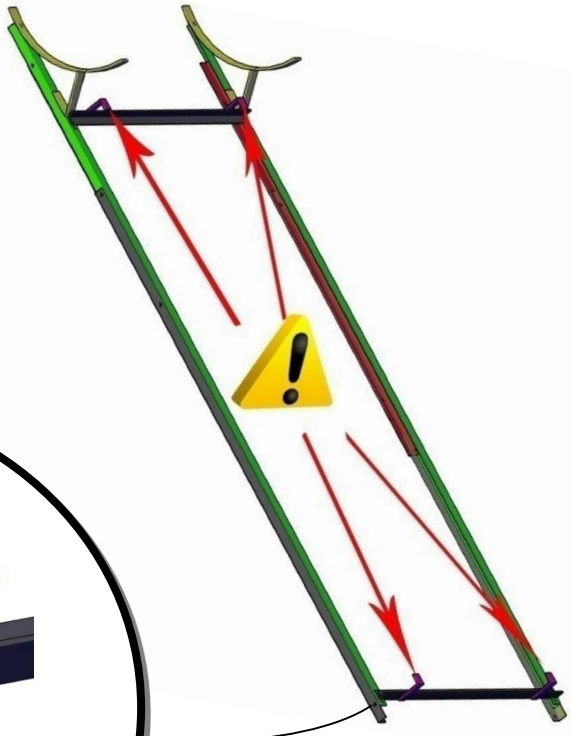
Step 5

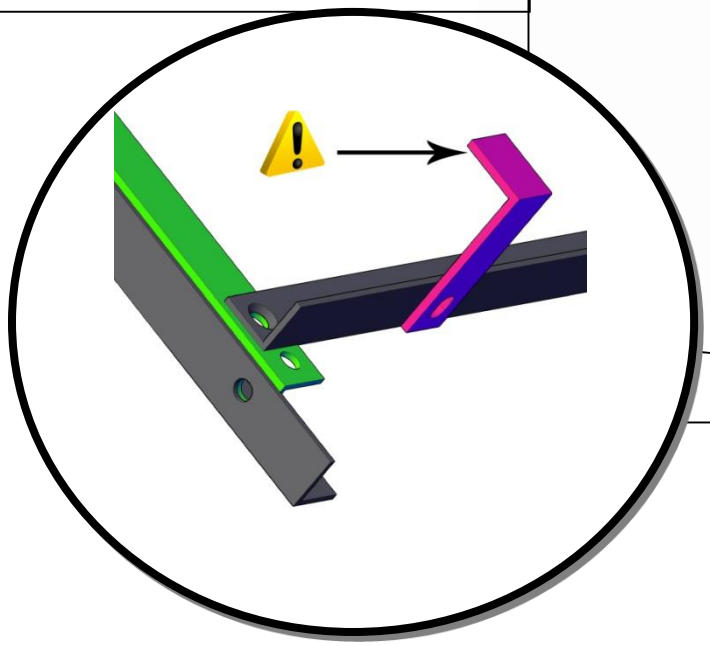


Step 6



Step 7





2. INSTALLATION OF THE THERMOSIPHON SYSTEMS

2.1. LOCATION OF SYSTEM

Before installing the system, both the necessary accessibility for maintenance work and structural resistance of the installation location must be taken into consideration. It must be installed with the support frame supplied by Termicol and preferably on a high place (terrace, roof, etc.).

Carefully measure the available space and leave an allowance area of at least 50 cm to the wall or the closest obstacle behind the system. As to the separation of the walls located to the South, keep the minimum distances to avoid shadows that will reduce the system performance.

The system must be installed as close as possible to the points of consumption so that the length of the pipe the hot water must run is as short as possible.

It must be oriented to the Geographic South (while allowing for small deviations whenever the current standard cannot be complied with) and free of shade or other objects within 180º of the facing part. If a compass is not available, a dial can be placed vertically at 12 o'clock sun time (2 p.m. in winter and 1 p.m. in winter). The shadow projected by this will be perpendicular to the active face of the collector.

The angle of the slope of the system with upper part tank is 35º (correct slope for year-round uses).

The lower tank system has a slope of 45º, which compensates for the loss of performance occurring by the unfavorable condition of the collector in the colder months.

The system frames are calculated by taking into consideration the current applicable standard for structural safety.

As to wind load, the calculation establishes a wind resistance for up to speeds equaling 1 kN/m^2

As to snow load, the frames are made to support a snow load of no greater than 0.3 kN/m2.

It is recommended to review the historic wind and snow load values where the system is going to be located and to strengthen the support frames in those cases where these values may be exceeded. Lastly, review the surface where the installation is going to be done by checking for freezing that could cause slipping accidents for either the system or personnel that have to install it.

2.2. SYSTEM HANDLING AND ASSEMBLY

HANDLING AND STORAGE

Termicol's products come perfectly wrapped for their proper keeping during transport and storage:

Collectors: Protected on the corners with cardboard and porexpan and shrink-wrapped.

Storage tanks: Wrapped in a high resistance cardboard box, which prevents scratching and facilitates stacking.

Accessories: Packed in cardboard boxes, which prevent damages during transport.

The following recommendations should be taken into consideration:

It is advisable to keep the different elements in their original package to avoid losses or damages. When you have to store the system for a lengthy period, don't forget that some elements have glazed surfaces. The glass, despite its great resistance abilities, is susceptible to being damaged by falling objects or accidental contacts. Place the objects in a reserved area that has little traffic.

To support several vertical collectors on a wall, they must be placed with a slope of between 70º and 80º, and with the glass covering facing the wall

Although they can be moved in any position, it is preferable that the storage tank be moved to the vertical position. The internal movement can be done through means of a lift truck if it has been fastened to a pallet.

None of the system components have special system hanging elements, so that, if necessary, they can be raised up by incorporating a fastening system that completely attaches them. This step should be done by a professional.

ASSEMBLY

It is advisable to cover the collectors once they are removed from the packaging for installing and, once installed, until the system is filled. This is to prevent accidental over-heating or burning.

Installation of the frame

Flat surface:

the frame that is provided is resistant to the most adverse conditions and has been designed to distribute the weight of the system in the structures four supports.

Sloped surface:

If the system is fixed to the surface through support bedplates (mortar, brick or cement), the four "feet of the frame" will transfer the weight of the system to the bedplates. These supports shall be made without damaging the impermeability or interfering with the drainage or damaging the roof tiles or elements making up the surface.

If it is attached through stainless steel plates; they will be set in the surface through rims, anchor resin or any setting system that guarantees a tight seal.

Connecting the collectors:

The connection of the collectors is set up for simple and easy assembly. The pre-mounted female compression fitting piece is found on the terminals to the left of the collector, while the male is on the right. Bring the collectors close to each other by centering them relative to the frame and do an initial hand tightening. Afterwards, finish tightening with an appropriate tool while insuring that the screw is positioned correctly.

Connecting the pipes.

Termicol system connection branches have quick compression fittings, which are premounted. To make the connection, bring together the cutting ring and the conical nipple and attach it with a loose nut. Tighten with an appropriate tool while making sure that the screw is positioned correctly.

If feedthroughs have to be made to do the system connection with the home hot water system, make sure to put on the insulation elements in order to prevent the entry of water or dampness. The use of weatherproofing resins or similar products is appropriate for these cases

Make sure that the cold and hot water piping insulation are insulated according to current regulations. A poorly insulated pipe can mean a big loss in energy as well as leaving it unprotected if temperatures fall below freezing. In addition, the protections must also be used on any purge system that is placed in the connection and consumption and hydraulic circuit.

It is necessary install dielectric elements in order to prevent the galvanic corrosion in the outlets of the tank. These elements are included in the kit of accessories and the installation is required to maintain the warranty conditions.

For safety reasons, connect the collectors to the storage system through a 16 mm^2 section of metallic tube. In addition, it is recommended that the system be connected to the building's lightning protection system. The metal conduit of the solar circuit cables shall be connected to the main equipotential busbar through a minimum 16 mm^2 CU (H07 V-U or R) lead (green/yellow). The ground can also be done through a ground rod by having the ground cable outside of the house. In addition, the ground has to be connected to the main equipotential busbar through an identical cross-section. Nevertheless, you should speak with a technician specializing in lightning protection whenever the collectors are going to be mounted on metal substructures

The connection of the safety valves and the purge lines will be connected so that they prevent the accumulation of dirt. As a result, the placement instructions must be followed for both the location of the system as well as their positioning and thus avoiding that the outlet area is directed upwards.

Correctly insulate the purge lines and safety valves to avoid possible freezing that could impair their proper functioning. In the case of the safety valves, place the outlet part facing downwards in order to prevent the fluid from accumulating within them and damaging the device if a freeze occurs.

Do not place stopcocks that prevent the functioning of the safety and expansion devices designed to protect the system. Any element that impedes their correct functioning would automatically invalidate the system's warranty.

All those purge lines that can be used in the installation must be prepared so that the gas or transfer medium that can be expelled does not cause any risk to people, material or the environment. To do so, it is suggested that the outlets be directed to drain pipes.

FILLING

The filling must be done in the early hours of the morning, during sunset or the rest of the day if the collectors are kept covered. **The secondary circuit** must always be filled **before the first.**

First circuit: is the circuit made up of the collectors and the pipes that tie them together, where the working fluid collects the thermal energy produced in the collectors and transfers it to the solar storage tank.

Secondary/consumption circuit: is the circuit where the captured energy is collected in the primary circuit and transferred to the consumption circuit.

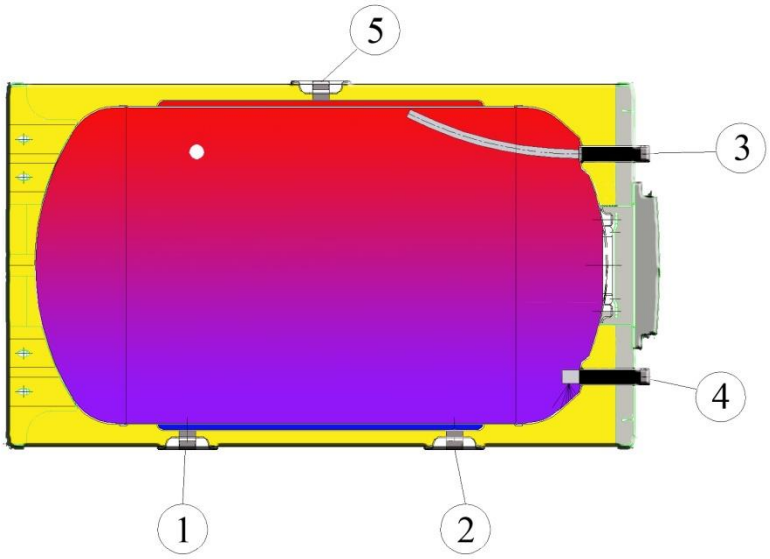
If the pressure at the inlet of the home is greater than 400 kPa (4 bars), installation of a pressure reducer that protects the whole system is recommended.

The copper piping of the primary solar circuit must be insulated with 20 mm. pipe covering if the piping runs through the inside of the home, or 30 mm. if it runs on the outside. This insulation will be properly protected with a special weatherproofing paint and will be supported in accordance current standards.

A safety assembly made up of a safety valve set at 8 bar and a check valve and a vacuum device is mounted at the system water inlet to the tank.

In order to isolate the storage tank and allow for doing repairs or necessary maintenance without having to empty the entire installation, a cut-off valve must be installed both at the cold water inlet as well as the hot water outlet.

The side area of the tank has 4 ports (see attached drawing).



- The upper ports (1 and 2) are outlets of the primary circuit double wall:
- An T and a 2.5 bar safety valve are attached to port "2".
- Port "2" is connected to the upper section panel (short coupling).
- The central ports (3 and 4) are connected to the home's consumption system:
- Port "3" is for the consumption water outlet to which a **thermostatic mixing valve and a thermal relief valve** must be attached**.**
- Port "4" is for the water system inlet to which an elbow and the safety and retention assembly is attached.
- Once the appropriate pressure tests have been done to the installation, you can proceed to filling the primary circuit.

The **filling of the** thermosiphon system's **primary circuit** can be done with a mixture of water and non-toxic anti-freeze. It is recommended that you use the one supplied by Termicol, which is made with propylene glycol and a percentage of anti-corrosives that help protect the system and lengthens its average life span.

% in Volume	20	25	30	35	40	45	50
Protection Temperature (ºC)	-8	-11	-15	-18	-23	-28	-36

To fill the system, put in the required amount of anti-freeze fluid mix through the upper port (1) according to the minimum temperatures of the area and in accordance with the instructions of the anti-freeze manufacturer. Remember that the concentration limits of the fluid goes since 20% to 50%.

To facilitate the exiting of air during the filling, we recommend unscrewing the plug until the primary fluid fills the same place. From that moment, the entering of the fluid and the exiting of the air is done though the upper port (5).

Once the primary circuit is completely filled, the plug on the top of the tank (5) must be screwed..

Under normal operation of the system, a **vapour chamber** is formed between the two upper ports (1 and 2) that acts as an expansion tank for the primary circuit. The limit of this chamber is always above of the circulation area of fluid, which allows free circulation of the primary fluid through thermosiphon effect.

The use of this type of system is not recommended in areas with high freezing risks. Nevertheless, if the time of year and/or the area is subject to low temperatures, (less than 0ºC); follow the safety guidelines to avoid damage from freezing during the first hours of operation of the system:

- Do not leave the primary circuit full of water after doing the sealing test. If necessary, do this test with a sufficient percentage of anti-freeze, which will be determined according to the temperatures reached in the area where the system is to be installed.
- Properly insulate the cold water piping to it from freezing.
- Mix the solar fluid in a container prior to putting it into the primary circuit. This prevents areas of low concentration of fluid during the first few days of operation.

2.3. OPERATIONAL VALUES AND WORKING LIMITS

Primary circuit:

The pressure in the primary circuit of the **thermosiphon system** varies between 100 kPa (1 bar) and 250 kPa (2.5 bar). The secondary circuit temperature can vary between the area's tap water temperature and 100 ºC, although the systems are ready to support considerably higher values during periods of low consumption. For this reason, it is recommended that a thermal relief valve be attached to the storage hot water outlet.

Secondary circuit:

The maximum operating pressure of the secondary circuit is 800 kPa (8 bar). The systems are protected by a safety and retention assembly gauged at 800 kPa (8 bar) attached to the cold tap water inlet. Even so, if the pressure of the storage system is greater than 400 kPa (4 bar); the installation of a pressure reducer to the storage tank cold water inlet is suggested.

En la siguiente tabla se resumen los valores nominales de funcionamiento para los equipos solares:

The nominal operating values for the solar equipment are summarized in the following table:

	Primary circuit	Secondary circuit
Thermosiphon circuit	Tmáx = 110 ºC ; Tmin = -18 ºC*	Tmáx > 90 ºC ; Tmin = 4 ºC
	Pmáx = 250 kPa ; Pinicial = 100 kPa	Pmáx = 800 kPa ; Ptrabajo = 200 a 600 kPa

*This temperature could change depending on the concentration of solar fluid that is added in the primary circuit. see solar fluid specifications

2.4. DELIVERY AND FUNCTIONAL TESTING OF THE EQUIPMENT

The installer is responsible for testing the functions, proper operation of the installation and its condition upon delivery to the property.

The installer, unless expressly stated otherwise, will deliver the installation full and operational.

To test for sealing, all the piping systems must be hydrostatically tested before being covered by brickwork or insulating material.

The tests will be done in accordance with UNE 100.151 "Seal Testing in Piping Systems".

In addition, the systems and auxiliary circuits will be hydrostatically tested when appropriate.

The safety valves will be checked to see that they are working and that their outlet pipes unplugged and connected to the atmosphere. The test will be done by increments until the value is 1.1 that of the gauge and by checking to see that the valve opens.

The proper functioning of the cut-off valves will be checked when filling, emptying and purging the equipment.

Upon receiving the equipment, it will be understood that it is operating properly when the equipment satisfies the partial tests included in this chapter.

A security assembly that limits the temperature of the water will be attached to the system outlet as a system for protecting against burns.

We provide a checklist in order to note down all those aspects of the system that we believe are important to review before finalizing the installation. The list has two parts that help in finishing the job.

The first part allows for a review just after finishing the assembly and filling of the system.

The second must be gone over after letting the system work for at least an hour on a sunny day. This check will not be valid unless there has been a minimum direct exposure of sun.

PRE-CHECK	
Pipes	
Presence of inverted siphons	
Leaks in the connections	
Proper placement of insulation	
Storage tank	
Proper anchoring	
Safety valves checked	
Proper levels	
Collector/s	
Joints	
Proper levels	
Clean glass	
Anti-lightning lead attached	
OPERATING CHECK	
Inlet branch to the collector must be cold	
Outlet branch from the collector must be hot	
Increase in consumption water temperature after 1 hour of operation (with direct sun). Perform an extraction.	

2.5. SYSTEM CONECTIONS

The maximum recommended number of **parallel** connections between systems of the same model with compensated hydraulic circuit is three. In this case, all the systems' cold water inlets will be joined together and at the same time as all the hot water outlets towards the consumption equipment. To tie the systems together in the cases described, 20mm interior diameter pipe can be used.

Due to the operational design of the these systems, by producing hot water exceeding 50º C. even on low radiation days, the assembly of more than two systems **in series** is not recommended. To do so, the hot water outlet of the first system must be tied to the cold water inlet of the second. As a result, the tap water inlet connection is done through the first system and the hot water outlet to consumption occurs through the second.

2.6. CONNECTION OF THE AUXILIARY ENERGY SYSTEM

The auxiliary system connection is done **in series** with an auxiliary by-pass.

Modulating thermostatic heaters are recommended where the water coming from the solar energy system is connected in series with the auxiliary energy. If the water coming from the solar energy system has adequate temperature, then the heater does not activate. If the water comes pre-heated but without the required temperature, then the heater activates and contributes the necessary energy for reaching the assigned temperature. The boiler or thermostatic modulating heater has to be sized for providing the maximum power under the most unfavorable conditions that occur on days where there is practically no radiation or days where maintenance work is performed on the solar equipment.

In any case, check with the manufacturer of the auxiliary system on its working capacity with pre-heated water.

Parallel connection is not recommended although it could be done under the following circumstances:

- When regulating the water outlet temperature is impossible.
- If the auxiliary system is made up of one more non-modulating heaters.
- If there is a pre-existing solar energy system that makes it difficult or impedes in series connections.

2.7. DISASSEMBLY AND RECYCLING OF THE SYSTEM

When the system must be disassembled for transport to another location or because it has reached the end of its useful life, take the following steps:

1. Empty the primary circuit by collecting the solar fluid in a container to avoid accidental spillage in the house.
2. Close the opening of the cold water inlet, remove the connection and empty the solar storage tank through the emptying area while trying to pour the water into an area where it can be used in another application. Be careful not to spill on sensitive areas of the house.
3. Remove the connection branches from the primary circuit by using two wrenches so as to avoid damaging the pipes, especially in the part where they connect to the collectors.
4. Loosen the fastening clamps of the frame and remove the collectors. If the system is going to be relocated to another location, protect the collectors both from solar radiation and possible knocks that could damage them.
5. Remove the storage tank connections to the consumption system.
6. Unscrew the storage tank fastening elements from the frame and remove the storage tank from it. Use a crane if necessary to avoid unnecessary risks.
7. Loosen the screws from the frame by starting with removing its component bars
8. Try to wrap up all the pieces of the system to prevent damage while in transport and being especially careful with the collectors and storage tanks.

RECYCLING

Most of the products that the thermosiphon systems are made of are recyclable. The solar collectors can be completely taken apart. The different materials can be separated and sent to a recycling center for their later use.

3. SUGGESTED USES

It is very important to keep in mind that the thermosiphon systems are designed to heat a certain amount of water on a daily basis. The volume of the storage tank gives a fairly approximate daily estimate of what the system can supply on average over a year. However, depending on the sunlight, climate and consumption conditions, these returns can vary radically. In the following table, an estimate is given of the specified amount that the system supplies at 45ºC while considering an average temperature of 15ºC in the tap water supply and according to the model chosen.

	Collector Modell	Nº collectors	Tank model	Allowable Average Daily Load Range (l/day)
TA150UF	T20US	1	ATF150I	120
TA150PF	T20PS			100
TA150UFM	T25US	1	ATF150I	140
TA150PFM	T25PS			130
TA200UFX	T20US	1	ATF200I	150
TA200PFX	T20PS			140
TA200UF	T25US	1	ATF200I	180
TA200PF	T25PS			160
TA200UFM	T20US	2	ATF200I	210
TA200PFM	T20PS			190
TA250UF	T25US	1	ATF250I	210
TA250PF	T25PS			200
TA250UFM	T20US	2	ATF250I	240
TA250PFM	T20PS			230
TA300UFX	T25US	1	ATF300I	250
TA300PFX	T25PS			240
TA300UF	T20US	2	ATF300I	280
TA300PF	T20PS			260
TA300UFM	T25US	2	ATF300I	300
TA300PFM	T25PS			290

Keep in mind that the interpretation of this table takes into account that the load range shown is the average amount of water that can be guaranteed in an average day for a fixed amount of radiation. A change in any of the parameters will mean a variation in the values expressed.

Given that the T300ASE model has been tested based on the EN12976 standard, the load and energy return results from this are given by the results of this test. Consequently, and in compliance with the standard, this data provided by the Centro Nacional de Energías Renovables [National Center for Renewable Energy (CENER)] is shown next.

- The recommended load range for the system (in l/day) at the specified temperature: 230 l/day

- Heat return and solar fraction of the agreed system for loads in the range of recommended loads.

Long term heat return data and solar fraction from the test for load volumes of 230 l/day for EN12976 Standard benchmark locations and conditions:

FAMILY TA – UF

TA150UF

The load range recommended by the system (l / day) at the specified temperature: 120 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 120 l / day for locations and reference conditions of standard EN12976

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**120** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	6698	2974	44,4	
Würzburg (49,5ºN)	6423	3106	48,4	
Davos (46,8ºN)	7267	4317	59,4	
Athens (38,0ºN)	4991	3845	77,0	

TA150UFM

The load range recommended by the system (l / day) at the specified temperature: 140 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 140 l / day for locations and reference conditions of standard EN12976

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**140** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	7814	3730	47,7	
Würzburg (49,5ºN)	7494	3832	51,1	
Davos (46,8ºN)	8479	5486	64,7	
Athens (38,0ºN)	5823	4716	81,0	

TA200UFX

The load range recommended by the system (l / day) at the specified temperature: 150 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 150 l / day for locations and reference conditions of standard EN12976

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**150** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	8372	3187	38,1	
Würzburg (49,5ºN)	8029	3371	42,0	
Davos (46,8ºN)	9084	4525	49,8	
Athens (38,0ºN)	6239	4374	70,1	

TA200UF

The load range recommended by the system (l / day) at the specified temperature: 180 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 180 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**180** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	10047	4174	41,5	
Würzburg (49,5ºN)	9635	4374	45,4	
Davos (46,8ºN)	10901	6014	55,2	
Athens (38,0ºN)	7487	5540	74,0	

TA200UFM

The load range recommended by the system (l / day) at the specified temperature: 210 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 210 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**210** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	11721	5649	48,2	
Würzburg (49,5ºN)	11240	5788	51,5	
Davos (46,8ºN)	12718	8329	65,5	
Athens (38,0ºN)	8734	7117	81,5	

The over temperature protection test have been done to the TA200UFM model because the ratio Area/Volume is the highest of the family TA-UF. The results of the test are the following:

The total solar radiation in the plane of the sensor during the test temperature protection was of 104.3 MJ/m2, reaching a maximum temperature of the solar output of 83.8 ° C. When the system to operate several days without removal of water until an accumulated solar radiation sensor in the plane than 104.3 MJ/m2, this can lead to overheating in the system. Before this happens, it will draw water from the solar storage tank to a volume approximately 3 times their content.

TA250UF

The load range recommended by the system (l / day) at the specified temperature: 210 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 210 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**210** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	11721	4385	37,4	
Würzburg (49,5ºN)	11240	4649	41,4	
Davos (46,8ºN)	12718	6233	49,0	
Athens (38,0ºN)	8734	6049	69,3	

TA250UFM

The load range recommended by the system (l / day) at the specified temperature: 240 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 240 l / day for locations and reference conditions of standard EN12976

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**240** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	13396	6128	45,7	
Würzburg (49,5ºN)	12846	6329	49,3	
Davos (46,8ºN)	14535	8968	61,7	
Athens (38,0ºN)	9982	7863	78,8	

TA300UFX

The load range recommended by the system (l / day) at the specified temperature: 250 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 250 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**250** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	13954	4514	32,4	
Würzburg (49,5ºN)	13381	4809	35,9	
Davos (46,8ºN)	15140	6333	41,8	
Athens (38,0ºN)	10398	6561	63,1	

TA300UF

The load range recommended by the system (l / day) at the specified temperature: 280 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 280 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**280** **l/día** *l/day*
Localidad */ Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	15629	6587	42,1	
Würzburg (49,5ºN)	14987	6882	45,9	
Davos (46,8ºN)	16957	9517	56,1	
Athens (38,0ºN)	11646	8696	74,7	

TA300UFM

The load range recommended by the system (l / day) at the specified temperature: 300 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 300 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**300** **l/día** *l/day*
Localidad */ Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	16745	7726	46,1	
Würzburg (49,5ºN)	16058	7973	49,7	
Davos (46,8ºN)	18168	11328	62,4	
Athens (38,0ºN)	12478	9881	79,2	

FAMILY TA – PF

TA150PF

The load range recommended by the system (l / day) at the specified temperature: 100 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 100 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**100** **l/día** *l/day*
Localidad */ Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	5582	2181	39,1	
Würzburg (49,5ºN)	5353	2301	43,0	
Davos (46,8ºN)	6056	3111	51,4	
Athens (38,0ºN)	4159	2975	71,5	

TA150PFM

The load range recommended by the system (l / day) at the specified temperature: 130 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 130 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**130** **l/día** *l/day*
Localidad */ Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	7256	3035	41,8	
Würzburg (49,5ºN)	6958	3165	45,5	
Davos (46,8ºN)	7873	4402	55,9	
Athens (38,0ºN)	5407	4049	74,9	

TA200PFX

The load range recommended by the system (l / day) at the specified temperature: 140 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 140 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**140** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	7814	2632	33,7	
Würzburg (49,5ºN)	7494	2799	37,3	
Davos (46,8ºN)	8479	3686	43,5	
Athens (38,0ºN)	5823	3789	65,1	

TA200PF

The load range recommended by the system (l / day) at the specified temperature: 160 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 160 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**160** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	8931	3331	37,3	
Würzburg (49,5ºN)	8564	3521	41,1	
Davos (46,8ºN)	9690	4742	48,9	
Athens (38,0ºN)	6655	4624	69,5	

TA200PFM

The load range recommended by the system (l / day) at the specified temperature: 190 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 190 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**190** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	10605	4531	42,7	
Würzburg (49,5ºN)	10170	4710	46,3	
Davos (46,8ºN)	11507	6615	57,5	
Athens (38,0ºN)	7903	5999	75,9	

The over temperature protection test have been done to the TA200PFM model because the ratio Area/Volume is the highest of the family TA-UF. The results of the test are the following:

The total solar radiation in the plane of the sensor during the test temperature protection was of 104.3 MJ/m2, reaching a maximum temperature of the solar output of 71.5 ° C.
When the system to operate several days without removal of water until an accumulated solar radiation sensor in the plane than 104.3 MJ/m2, this can lead to overheating in the system. Before this happens, it will draw water from the solar storage tank to a volume

approximately 3 times their content.

TA250PF

The load range recommended by the system (l / day) at the specified temperature: 200 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 200 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**200** **l/día** *l/day*
Localidad */ Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	11163	3671	32,9	
Würzburg (49,5ºN)	10705	3903	36,5	
Davos (46,8ºN)	12112	5146	42,5	
Athens (38,0ºN)	8319	5319	63,9	

TA250PFM

The load range recommended by the system (l / day) at the specified temperature: 230 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 230 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**230** **l/día** *l/day*
Localidad */ Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	12838	5084	39,6	
Würzburg (49,5ºN)	12311	5342	43,4	
Davos (46,8ºN)	13929	7340	52,7	
Athens (38,0ºN)	9566	6913	72,3	

TA300PFX

The load range recommended by the system (l / day) at the specified temperature: 240 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 240 l / day for locations and reference conditions of standard EN12976

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**240** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	13396	3916	29,2	
Würzburg (49,5ºN)	12846	4168	32,4	
Davos (46,8ºN)	14535	5430	37,4	
Athens (38,0ºN)	9982	5859	58,7	

TA300PF

The load range recommended by the system (l / day) at the specified temperature: 260 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 260 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**260** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	14512	5404	37,2	
Würzburg (49,5ºN)	13917	5714	41,1	
Davos (46,8ºN)	15746	7726	49,1	
Athens (38,0ºN)	10814	7507	69,4	

TA300PFM

The load range recommended by the system (l / day) at the specified temperature: 290 l / day at 45 ° C Thermal efficiency and solar fraction of the system according to loads in the load range recommended. Data from long-term thermal performance and solar fraction determined from the test for load volumes of 290 l / day for locations and reference conditions of standard EN12976:

Indicadores de rendimiento del sistema únicamente solar o de precalentamento solar sobre la base anual de un volumen de demanda de: *Performance indicators for solar-only and solar preheat Systems on annual base for a demand volume of :*				**290** **l/día** *l/day*
Localidad / *Location* **(latitud** / latitude**)**	**Q_d [MJ]**	**Q_L [MJ]**	**f_{sol} [%]**	**Q_{par} [MJ]**
Stockholm (59,6ºN)	16187	6606	40,8	
Würzburg (49,5ºN)	15522	6917	44,6	
Davos (46,8ºN)	17563	9582	54,6	
Athens (38,0ºN)	12062	8878	73,6	

The difference between the energy needs for heating the total volume and the amount that the solar collectors provide must be compensated for with the use of an auxiliary heating system using conventional energy. This also has to be used when, because of peak usage by the occupants of the home, domestic hot water use is increased. It must be used while observing, to the extent possible, energy

saving practices since it is never advisable to waste resources as precious as water and energy.

To do this, we suggest that you:

- Shower instead of taking a bath whenever possible in the peak radiation periods.
- Don't let leave the water running when it is not being used. Regulate the flow to what is needed at the time.
- Make sure that the water pressure is not too high. If you have a pumping set, regulate it properly. If it is supplied directly from the tap, install a pressure reducer.
- Fill the sink to shave, don't do it with the water running.

Lave los platos con el fregadero lleno, no lo haga con el grifo abierto.

Fill the sink to wash the dishes, don't do it with the water running. .

- Use hot water at an appropriate temperature (about 42 ºC) and set the auxiliary hot water system at the same.
- Periodically check for leaks in the equipment.
- Properly insulate sections of pipe where hot water circulates.
- Cover the panels if the system is not going to be used for a prolonged period of time.
- Keep in mind that the cheapest, most renewable and least polluting energy is that which is not used and try to adjust your consumption to that which is provided by solar energy.

As can be seen from the technical specifications for the systems, the designed limiting values are higher than the nominal operating values. This allows for the system to work under safe conditions within a confined range of pressure and temperature values.

For equipment that is used seasonally, we recommend covering the collectors for those periods when the system is not going to be used provided that this is in a place that is easily accessible and there are no risks of an accident. Another option is to empty the primary circuit, which would have to be done by an installation contractor

4. CARE AND MAINTENANCE PROGRAM

The objective of this section is to define what steps to follow for the proper maintenance of Termicol solar energy system. This contributes to their proper functioning, durability, reliability and availability and thus increases energy and economic savings.

Three levels are defined in the maintenance program for encompassing all the necessary operations to undertake during the useful life of the equipment and to insure its proper functioning as well as its durability, reliability and availability.

Three operation levels are established. The objectives to be achieved, actions to take and who must do them are set out for each level

Care

The care program is defined in the use manual and normally will be carried out by the user. The following is a summary of the things to do:

- Collectors: check to see it creates dampness or condensation.
- Storage tank: check to see if there are any leaks in the connections.
- Connections: check to see if there are any leaks, if the insulation is damp or if the paint that covers it is deteriorated.
- Frame: check to see if there is any corrosion and if the screws are well tightened.

Preventative Maintenance

Preventative maintenance includes visual inspection, checking operations and others that apply to seeing that the equipment is maintained and operated within their acceptable limits, operating conditions, loads, protection and durability.

At a minimum, preventative maintenance includes an annual review of equipment with a collector surface area of less than

20 m^2 and at least a six month review for equipment with collector surface area greater than 20 m^2.

Preventative maintenance shall be done by qualified and specialized technical personnel knowledgeable in thermal solar technology.

Any work done by non-qualified contractor will mean the cancelation of the warranty.

The equipment shall have a maintenance book where all the work done is documented.

Preventative maintenance includes work and replacement of fungible or worn out material, which is necessary to insure that the equipment functions.

Corrective Maintenance

This is work carried out as a result of the detection of a problem in the operation of the solar energy equipment during the care or preventative maintenance plan.

Corrective maintenance will be done by qualified and specialized technical personnel knowledgeable in thermal solar technology. The equipment shall have a maintenance book where all the work done is documented

The corrective maintenance includes the visit to the solar equipment each time that the user requires it for a serious breakdown of the solar equipment as well as the analysis and estimate for necessary work and replacement parts for its proper functioning.

If the user agrees with the estimate, the repair of the solar equipment will go forward and the user will pay the company the agreed maintenance amount.

CARE PLAN

Equipment Element	Operation	Frequency (months)	Description
COLLECTORS	Clean Glass	To be determined	With water an appropriate products
	Glass	3	VI Condensation in the main part of the day.
	Joints		VI Cracks and warping
	Absorber	3	VI Corrosion, warping, etc.
	Connections	3	VI Leaks
	Frame	3	VI Weakening, signs of corrosion.
PRIMARY CIRCUIT	Piping, insulation	6	VI Dampness and leaks.
SECONDARY CIRCUIT	Thermometer	Daily	VI Temperature
	Piping and insulation	6	VI Dampness and leaks
	Solar storage tank	3	Purging of the accumulation of sludge in the lower part of the tank

MAINTENANCE PLAN

Collectors

Equipment	Frequency (months)	Description
Collectors	6	VI Variations from original VI Variations among collectors
Glass	6	VI Condensation and dirt
Joints	6	VI Cracks and warping
Absorber	6	VI Corrosion, warping
Shell	6	VI Warping, unevenness, air holes
Connections	6	VI Appearance of leaks
Frame	6	VI Weakening, signs of corrosion and tightening of screws
Collectors*	12	Partial covering of the collector fields
Collectors*	12	Partial uncovering of the collector fields
Collectors*	12	Partial emptying of the collector fields
Collectors*	12	Partial filling of the collector fields

Storage Tank

Equipment	Frequency (months)	Description
Tank	12	Presence of sludge in the bottom
Sacrificial anodes	12	Check for wear
Insulation	12	Check for dampness
Coil exchanger	12	CF efficiency and performance. Cleaning

Hydraulic Circuit and Valves

Equipment	Frequency (months)	Description
Coolant fluid	12	Check density and pH
Leak tightness	24	Do pressure test
Insulation on the outside	6	VI weakening, joint protection and dampness
Insulation on the inside	12	VI joint and dampness
Cut-off valve	12	CF actions (opening and closing) to prevent seizing up
Safety valve	12	CF action

IV: Visual Inspection. CF: Check Functioning